

We claim:

1. A sensor for determining a length of an optical path, the sensor comprising:  
a light source configured to direct light along said optical path;  
at least one modulator optically coupled to said light source, said at least one  
5 modulator configured to modulate at least a portion of said light as a function of a modulation  
signal;  
a detector optically coupled to said at least one modulator configured to produce a  
detector output based upon a sensed intensity of said light at the end of said optical path; and  
an electronics system configured to receive said detector output, and to provide an  
output indicative of the optical path length.

2. The sensor of claim 1, wherein said modulation signal as a function of said  
detector output to produce a desired effect upon said light, whereby said length of said optical  
path is determined by said electronic system as a function of said modulation signal that  
produces said desired effect.

3. The sensor of claim 1, further comprising an optical splitter optically coupled  
between said light source and said at least one modulator, whereby light passing through said  
optical splitter is split into a first path and a second path.

4. The sensor of claim 3, wherein said detector output is indicative of the  
difference in phase in the light traveling along said first path and said second path.

5. The sensor of claim 1, wherein said modulation signal is generated at a  
frequency that is a function of the length of said optical path.

6. The sensor of claim 5, wherein said electronic system adjusts a frequency of said modulation signal in response to changes in said detector output to maintain said modulation signal at a frequency related to said optical path.

5 7. A method of determining a length of an optical path, the method comprising:  
generating a light along the optical path;  
splitting said light into a first beam and a second beam;  
modulating at least one of said first beam and said second beam in response to a  
modulation signal to induce a difference between said first beam and said second beam;  
re-combining said first beam and said second beam to generate a recombined signal;  
10 detecting an output intensity of said recombined signal at a detector;  
adjusting said modulation signal as a function of said output intensity; and  
computing said length of said optical path as a function of said modulation signal.

15 8. The method of claim 7, wherein said adjusting said modulation signal  
comprises maintaining said modulation signal at a frequency such that said output intensity  
remains substantially constant.

20 9. The method of claim 7, wherein said difference between said first beam and  
said second beam is a phase difference.

10. The method of claim 7, wherein said modulation signal is a ramp waveform  
having a frequency.

25 11. The method of claim 7, further comprising applying said modulation signal to

said second beam after a delay has elapsed since application of said modulation signal to said first beam, such that said delay is based upon said length of said optical path.

12. The method of claim 11, wherein said adjusting of said modulation signal comprises sampling said output intensity to determine differences in said output intensity over time.

13. The method of claim 12, wherein said adjusting of said modulation signal further comprises altering the frequency of said modulation signal to reduce said differences in said output intensity over time.

14. The method of claim 13, wherein said adjusting step comprises determining a proper frequency for said modulation signal such that differences in said output intensity are minimized over time.

15. The method of claim 14, wherein said computing of said length comprises determining said length of said optical path from said proper frequency.

16. A system for determining the length of an optical fiber under test, the system comprising:

a low coherence white light source configured to send light along an optical path defined by an optical fiber;

a phase modulator optically coupled to the light source for modulating at least a portion of the light in a first path relative to a second path;

a detector optically coupled to the optical path for producing a detector output based upon a length of the optical path; and

a processor for receiving the detector output, and for producing an output based upon the length of the optical path, wherein the light source has a coherence length shorter than a  
5 difference in path length between the first and the second paths.

17. The system of claim 16, further comprising a coupler between the white light source and the modulator.

18. The system of claim 17, wherein said coupler is a 2 x 2 coupler.

19. The system of claim 16, further comprising a delay fiber optically coupled to said fiber.

20. The system of claim 16, further comprising a connector for probing optical transducers at the end of a section of optical fiber.

21. The system of claim 16, further comprising telescope optics for transmitting and collecting light from objects or from the air.

22. The system of claim 16, wherein the processor receives the detector output such that the length of the optical path traveled by said light is determined.

23. the system of claim 16, wherein the processor receives the detector output such that a break fault in the fiber under test is determined.

We claim:

1. A sensor for determining a length of an optical path, the sensor comprising:  
a light source (102) configured to direct light along said optical path;  
at least one modulator (116, 118) optically coupled to said light source (102), said at  
5 least one modulator (116, 118) configured to modulate at least a portion of said light as a  
function of a modulation signal;  
a detector (108) optically coupled to said at least one modulator (116, 118) configured  
to produce a detector output based upon a sensed intensity of said light at the end of said  
optical path; and  
10 an electronic system (126) configured to receive said detector output (130), and to  
provide an output indicative of the optical path length.

2. The sensor of claim 1, wherein said modulation signal as a function of said  
detector output (130) to produce a desired effect upon said light, whereby said length of said  
15 optical path is determined by said electronic system as a function of said modulation signal  
that produces said desired effect.

3. The sensor of claim 1, further comprising an optical splitter (120) optically  
coupled between said light source (102) and said at least one modulator (116, 118), whereby  
20 light passing through said optical splitter (120) is split into a first path (132) and a second  
path (134).

4. The sensor of claim 3, wherein said detector output (130) is indicative of the  
difference in phase in the light traveling along said first path (132) and said second path  
25 (134).

5. The sensor of claim 1, wherein said modulation signal is generated at a frequency that is a function of the length of said optical path.

6. The sensor of claim 5, wherein said electronic system (126) adjusts a frequency of said modulation signal in response to changes in said detector output (130) to maintain said modulation signal at a frequency based upon said optical path.

7. A method of determining a length of an optical path, the method comprising:  
generating a light along the optical path;  
splitting said light into a first beam (132) and a second beam (134);  
modulating at least one of said first beam (132) and said second beam (134) in response to a modulation signal to induce a difference between said first beam (132) and said second beam (134);  
re-combining said first beam (132) and said second beam (134) to generate a recombined signal;  
detecting an output intensity of said recombined signal at a detector (108);  
adjusting said modulation signal as a function of said output intensity; and  
computing said length of said optical path as a function of said modulation signal.

8. The method of claim 7, wherein said adjusting said modulation signal comprises maintaining said modulation signal at a frequency such that said output intensity is maintained substantially constant.

9. The method of claim 7, wherein said difference between said first beam (132) and said second beam (134) is a phase difference.

10. The method of claim 7, wherein said modulation signal is a ramp waveform having a given frequency.

11. The method of claim 7, further comprising applying said modulation  
5 signal to said second beam (134) after a delay has elapsed since application of said modulation signal to said first beam (132), such that said delay is based upon said length of said optical path.

12. The method of claim 11, wherein said adjusting of said modulation signal  
10 comprises sampling said output intensity to determine differences in said output intensity over time.

13. The method of claim 12, wherein said adjusting of said modulation signal  
15 further comprises altering the frequency of said modulation signal to reduce said differences in said output intensity over time.

14. The method of claim 13, wherein said adjusting of said modulation signal  
comprises determining a proper frequency for said modulation signal such that differences in said output intensity are minimized over time.

15. The method of claim 14, wherein said computing of said length comprises  
determining said length of said optical path from said proper frequency.

16. A system (100) for determining the length of an optical fiber under test (150),  
the system comprising:

a low coherence white light source (102) configured to send light along an optical path defined by an optical fiber;

a phase modulator (107) optically coupled to the white light source (102) for modulating at least a portion of the light in a first path (132) relative to a second path (134);

5 a detector 108 optically coupled to the optical path (107) for producing a detector output (130) based upon a length of the optical path; and

a processor (126) for receiving the detector output (130), and for producing an output based on the length of the optical path, wherein the white light source (102) has a coherence length shorter than a difference in said length between the first path (132) and the second path  
10 (134).

17. The system of claim 16, further comprising a coupler between the white light source (102) and the phase modulator (107).

15 18. The system of claim 17, wherein said coupler is a 2 x 2 coupler (104).

19. The system of claim 16, further comprising a delay fiber (122) optically  
20 coupled to said fiber.

20. The system of claim 16, further comprising a connector (124) for probing  
25 optical transducers at the end of a section of the optical fiber.

21. The system of claim 16, further comprising telescope optics for transmitting  
30 and collecting light from objects or from the air.



22. The system of claim 16, wherein the processor (126) receives the detector output (130), such that the length of the optical path traveled by said light is determined.

23. The system of claim 16, wherein the processor (126) receives the detector  
5 output (130) such that a break fault in the fiber under test (150) is determined.